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XML-MTF
A Technology Opportunity to Position MTFs for the 21rst Century

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D540 - Information Interoperabilit
AC2ISRC/C2P

nted to the USMTF Standards Management Committee
23 February 1999

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Overview

- Motivation: A possible future
- The W3C and XML
- Relationship between XML and MTF
- Our opportunity
- An implementation strategy
- Benefits
- Related DoD activities
- Recommendations
- Additional information

What if …

- Industry leaders were fiercely competing to develop the best MTF products
- Every operating system, database, word processor and web browser came MTF ready
- MTFs were the fastest new web technology
- Every web head, technologist and computer scientist thought MTFs were really *cool*
- People with MTF experience were wildly marketable
- Researchers, scientists and developers worldwide were working 24-7 to invent the next MTF interoperability breakthrough

They Will *

*If you take action now!

World Wide Web Consortium (W3C)

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- Founded in 1994 to “lead the Web to its full potential”
  - Develop common protocols
  - Ensure interoperability
  - Promote WWW evolution
- Co-hosted by MIT (U.S.), INRIA (France) and Keio (Japan) Universities
- Supported by DARPA and the European Commission

W3C Members (Over 300)

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ABN AMRO Bank
Access
Access Company Limited
Acuity
Adobe Systems
AGFA
Agfa Division, Bayer Corp.
Agile Software
Agranat Systems
Alcatel Alsthom
Alfa-Omega Foundation
Allaron, Inc.
Allied Business Consulting, Inc.
Allied Corporation
America Online, Inc.
American Express
AND-Data Ltd.
AND-Data
APACS
Aplix Corporation
Apple Computer, Inc.
ArborText, Inc.
Architecture Projects Management Ltd.
Ardent Software, Inc.
ArrowPoint Communications
Art Technology Group
Asymetrix Corporation
AT&T
Attachmate Corporation
Autodesk, Inc.
BackWeb Technologies, Inc.
British Broadcasting Corporation
BEA Systems, Inc.
BELGACOM
Bitstream, Inc.
Bluestone Software
The Boeing Company
Bow Street, Inc.
Bowne Internet Solutions
University of Bristol
British Telecommunications Laboratories
Bull S.A.
Business Objects
Canon Inc.
Cap Gemini Innovation
CCTA
Center for Democracy and Technology
Center for Mathematics and Computer Science (CWI)
Center for Telematics and Information Technology (CTIT)
Centraal Corporation
CERN
China Times Interactive Co., Ltd.
Chunghwa Telecom Company, Ltd.
Cisco Systems
CITEC
CITIBANK, N.A.
CNET - The Computer Network
CNR--Instituto Elaborazione dellInformazione
CNRS
Coalition for Networked Information
COLLEGIS Research Institute
Commerce One
CommerceNet
Commissariat a l'Energie Atomique
Compaq Computer Corporation
Computer Associates International, Inc.
Computer Sciences Corporation
Cyberwave
CyberCash, Inc.
Daewoo Electronics Company
Data Channel
Data Interchange Standards Association (DISA)
Datalogics
Datapoint Corporation
Datasoft Corporation
Defense Information Systems Agency (DISA)
Department of Communications, Information Technology and the Arts
Deutsche Telekom Service GmbH
DFN Verein
Digital Equipment Corporation
Direct Marketing Technology, Inc.
Distributed Systems Technology Centre (DSTC Pty Ltd)
DoCoMo
Dresdner Bank
Ecrin Systems
Ecole Nationale Supérieure dinformatique et de Mathématiques Appliquées (ENSIMAG)
University of Edinburgh (HCRC Language Technology Group)
EEIG/ERCIM
Electricité de France
Electronic Network Consortium
ENEL
Engage Technologies
Enigma
ENN Corporation
Entrust Technologies, Inc.
Epicentric, Inc.
Eprise Corporation
ERICSSON
Ernst & Young LLP
ETNOTEAM S.p.A.
EUnet International BV
Excosoft
Federal Geographic Data Committee
Fermi National Accelerator Laboratory
FIZ Karlsruhe (FachInformationsZentrum)
Fraunhofer Institut Informatik (FZI)
Foundation for Research and Technology (FORTH)
France Telecom
Fraunhofer IGD
Fretwell-Downing Data
FSTC (Financial Services Technology Consortium)
Fujitsu Limited
Fulcrum Technologies, Inc.
GE Information Services, Inc.
GEMPLUS
General Magic, Inc.
GEO Interactive Media Group Ltd.
George Washington University
Geoworks
GlobeID Software
GMD National Research Center for Information Technology
Graphic Communications Association
Grenoble Network Initiative
Groove Networks, Inc.
Groupe ESC Grenoble
GTW Associates
Harlequin Inc.
Health Level Seven, Inc.
The Hebrew University of Jerusalem
Helsinki Telephone Corporation
Hewlett Packard Company
Hitachi, Ltd.
Hongik University
Hummingbird Communications Ltd.
HTML Writers Guild
Hyperwave Information Management, Ges. m.b.H.
IBERDROLA S.A.
IBM
ICL
IDEAlliance
IMAG
IMG SRC, Inc.
Industrial Technology Research Institute
Infopartners
Information Bridge Internet Consulting
Information Builders, Inc.
Informix Software, Inc.
Inktomi Corporation
INRIA
Institut National de Recherche en Informatique et en Automatique
Institute for Computer Sciences, Social-Informatics and Telecommunications Engineering (ICCS)
Intel Corporation
Intelink Management Office (IMO)
Interleaf, Inc.
Intermind
International Integrated Systems, Inc.
Internet Initiative Japan Inc.
Internet Security Systems, Inc.
Interse Corporation
Intraspect Software, Inc.
iReady Corporation
JetForm
Joint Info. Systems Comm. of the UK Higher Ed. Funding Council
KnowledgeCite, Inc.
Lawrence Berkeley National Laboratory
Landmark International, Inc.
Los Alamos National Laboratory
Lotus Development Corporation
Lucent Technologies Inc.
Lycos, Inc.
Matra Hachette
MatchLogic, Inc.
Matra Hachette
Matsushita Electric Industrial Co., Ltd.
Mediasoft Network
Merrin Information Services
Metropolitan Software
Microelectronics and Computer Technology Corporation
Microstar Software Ltd.
Microsystems Software, Inc.
MindQuake Interactive, Inc.
MITRE Corporation
Mitsubishi Electric Corporation
Motorola
NAKI
SAIC Research Center
National Chiao Tung University
National Taiwan University
National Technology Agency of Singapore
NCR
NEC Corporation
NETAWAY
Netscape Communications Corporation
Nippon Telegraph and Telephone Corporation
NOKIA Corporation
Nortel
Novell, Inc.
NTT Data Corporation
NTT Mobile Communications Network, Inc. (NTT DoCoMo)
OReilly & Associates, Inc.
Organization for the Advancement of Structured Information Standards (OASIS)
Object Design
Object Management Group, Inc. (OMG)
Obvious Services and Consulting, Inc.
Online Business Consulting Services
Open Market, Inc.
Open Software Associates, Inc.
Open Text Corporation
Oracle Corporation
Pacific Softworks
Paradigm Development Corporation
Partners HealthCare System, Inc.
Pencom Web Works
Perspecta
Pervasive Software
Philips Electronics N.V.
Planetweb, Inc.
Pretty Good Privacy, Inc.
The Productivity Works, Inc.
Qualcomm Incorporated
Quark, Inc.
Rapid Logic
Raptor Systems, Inc.
RealNetworks
Reed Elsevier
Reuters Limited
Rivcom
Riverland Holding NV/SA
Royal Melbourne Institute of Technology
Royal National Institute for the Blind (RNIB)
S.W.I.F.T. SC
SAIC/Bellcore
Sandpiper Networks, Inc.
SAP AG
SBC Technology Resources
Security Dynamics Technologies, Inc.
Segue Software
Sema Group
Sharp Corporation
SICS
Silicon Networks, Inc.
Skyline
Software AG
Springer-Verlag (Publishing)
SRI, Ltd.
Stanford Corporation
University of Stuttgart
Sun Microsystems, Inc.
surfCONTROL
SURFnet bv
Swedish Institute for Systems Development (SISU)
Sybase, Inc.
Sybase
Tandem Computers, a division of Compaq
Technische Universitat Graz
Tektronix Corporation
Telecom Colombia
Telecom Italia
Telefonica
The Open Group
Thomson Corporation
TIBCO
TNO Multimedia and Telecommunications
Toshiba Corporation
Toyota Motor Corporation
Trilogy Technologies, Inc.
TRUSTe
2Bridge Software
UNINA
United States Environmental Protection Agency (EPA)
Unisys Corporation
Verisign, Inc.
VTT Information Technology
Wall Data Incorporated
Waterloo Maple
webMethods, Inc.
WebTV Networks Inc.
WinWriters
Wolfram Research, Inc.
worldweb
Xerox Corporation
XMLKR
Yahoo!
Yokogawa Electric Corporation

DISA
Motorola
Intel
Sony
IBM
Nation
Compaq
Novell
Microsoft
AT&T
Cisco
Netscape
Apple
Lotus
Corel
Oracle
Boeing
Sun
Labs
HP
NSA
Xerox
Adobe
GE
Kodak

The eXtensible Markup Language

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- An international industry standard for describing and sharing structured information
  - Man readable
  - Machine processable
  - Hierarchically structured
  - Equally adept at data and free text
- Migrates the Web from “one big brochure” to “one big data source”
- Particularly well suited for Web environments, but not restricted to them
- Approved by the W3C in Feb’ 98

Core Technologies (Since Feb98)

- XML Schemas: describe structure and content
- XQL: query and retrieve
- XSL: translate and present
- DOM: standard Application Interface (API)
- RDF: resource discovery
- Namespaces: disambiguate domains
- Xlink: advanced linking

Industry Response

- Microsoft
  - Office 2000 to provide native XML support
  - MS Windows to provide XML processing services
  - IE 5.0 (XML, XSL, DOM, Schemas, Namespaces)
- Oracle
  - Annouces “sweeping support”, e.g., Oracle 8i
- IBM alphaWorks
  - Released 10 tools for XML (all free)
- Free XML-java parsers: Sun, IBM, Oracle, MS
- Many, many others ...

What does this have to do with MTFs?

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- Industry has finally recognized the value of MTFs and is rallying around our flag pole!
- For the first time, there is a pervasive, industry standard for sharing MTF information
- XML Documents are MTFs for the Web

XML and MTF Correspondence (two views of the same data)

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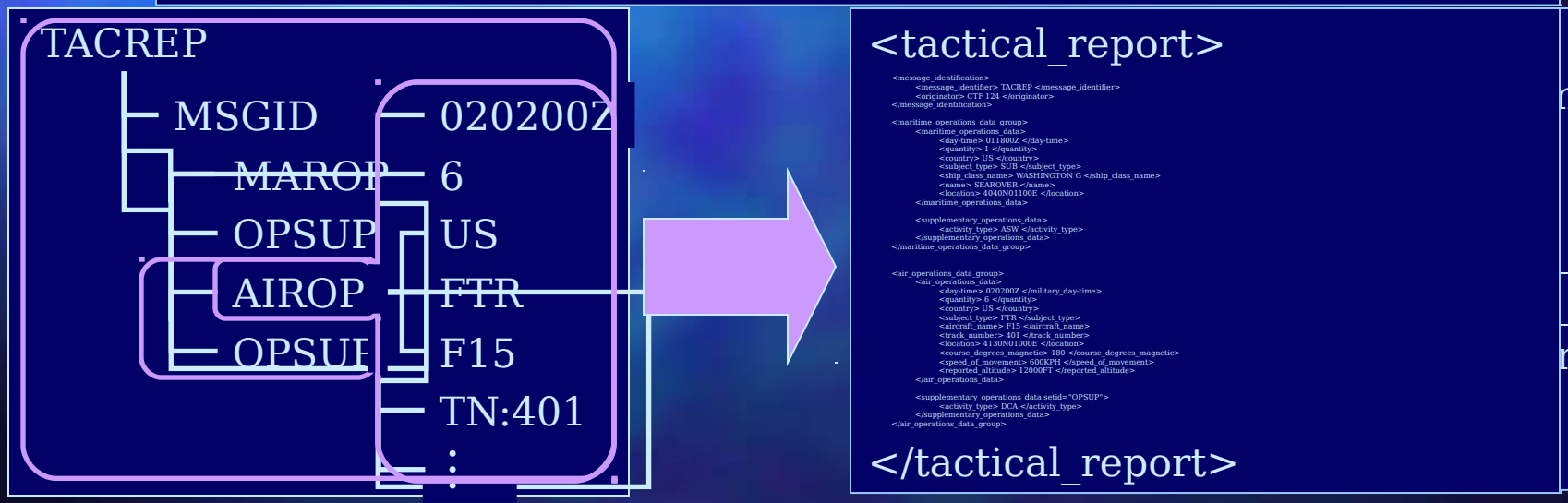
MSGID/TACREP/CTF 124//
MAROP/011800Z/1/US/SUB/CL:WASHINGTON/NAME:SEAROVER
/LM:4040N01100E//
OPSUP/ACTTYP:ASW//
AIROP/020200Z/6/US/FTR/F15/TN:401/LM:4130N01000E/CRS:180/
SPD:600KPH
/ALT:12000FT//
OPSUP/ACTTYP:DCA//



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<message_identifier> TACREP </message_identifier>
<originator> CTF 124 </originator>
</message_identification>

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<name> SEAROVER </name>
<location> 4040N01100E </location>
</maritime_operations_data>

<supplementary_operations_data>
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</supplementary_operations_data>
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<air_operations_data_group>
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<quantity> 6 </quantity>
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<subject_type> FTR </subject_type>
<aircraft_name> F15 </aircraft_name>
<track_number> 401 </track_number>
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</air_operations_data>

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<activity_type> DCA </activity_type>
</supplementary_operations_data>
</air_operations_data_group>

</tactical_report>

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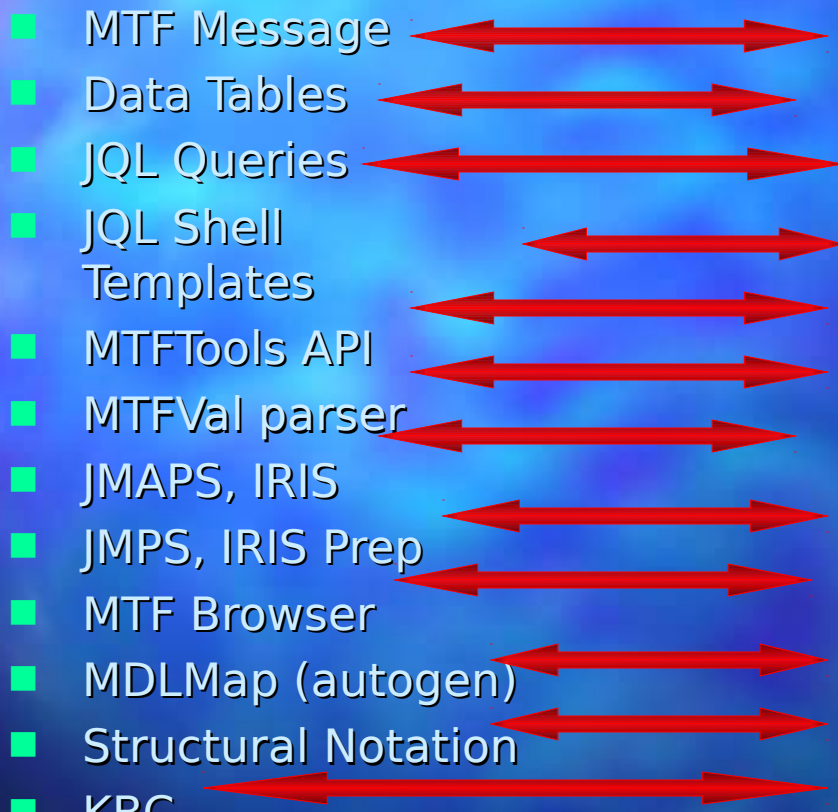
XML - MTF Related Technologies



XML approaches are industry standard, inexpensive, powerful and rapidly evolving - being driven by the dynamics of the commercial marketplace. The DOD-proprietary suite of MTF capabilities will remain relatively static.

Our Opportunity

- Capitalize on investment in military information standards, such as USMTF, ADatP-3, ADFORMs, …
  - Capture large, well documented collection of IERs
  - Cross domain, service and international boundaries
  - Have Allied, Service, CINC and Agency buy-in
- Allow XML as information container
  - Ubiquitous commercial support
  - High quality, inexpensive, rapidly evolving tools
  - Enables modern information distribution techniques
- Evaluate newly afforded capabilities
  - Multi-media, rich formatting, distributed collaboration
  - Flexible customization, fusion, regional extensions

Implementation Strategy Situation Today

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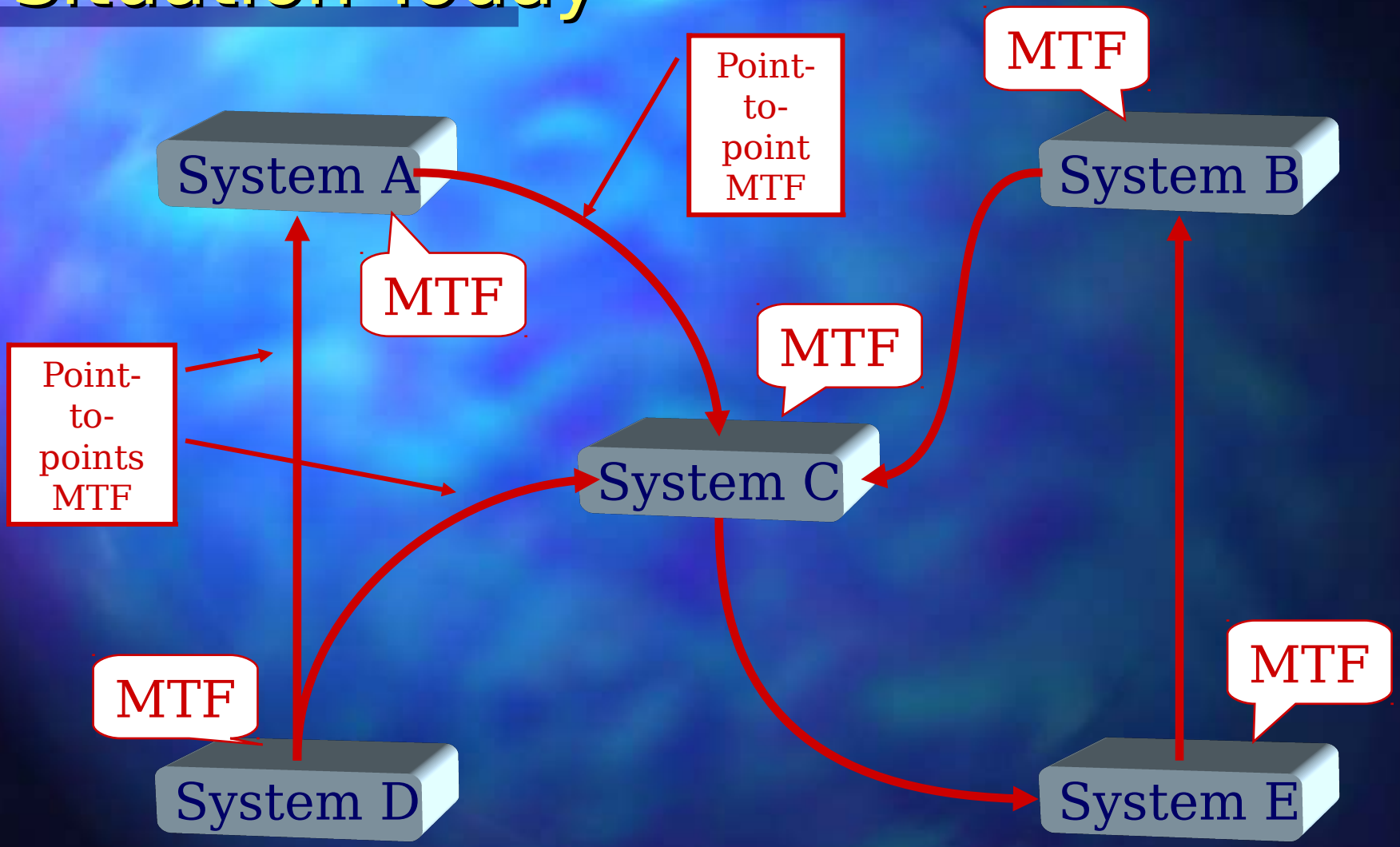

Implementation Strategy
Single XML-MTF System

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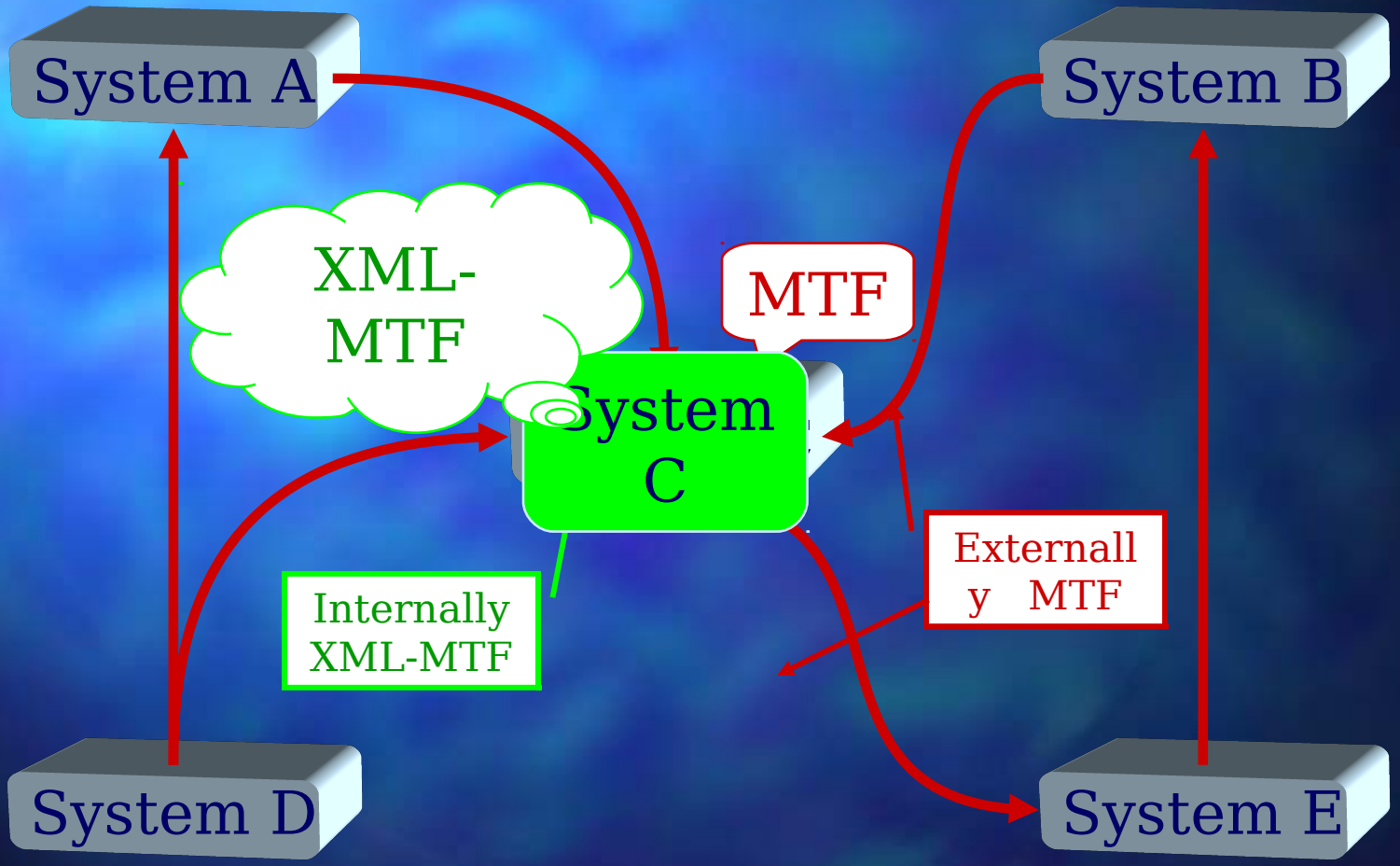

Implementation Strategy
Simple XML-MTF Transfer

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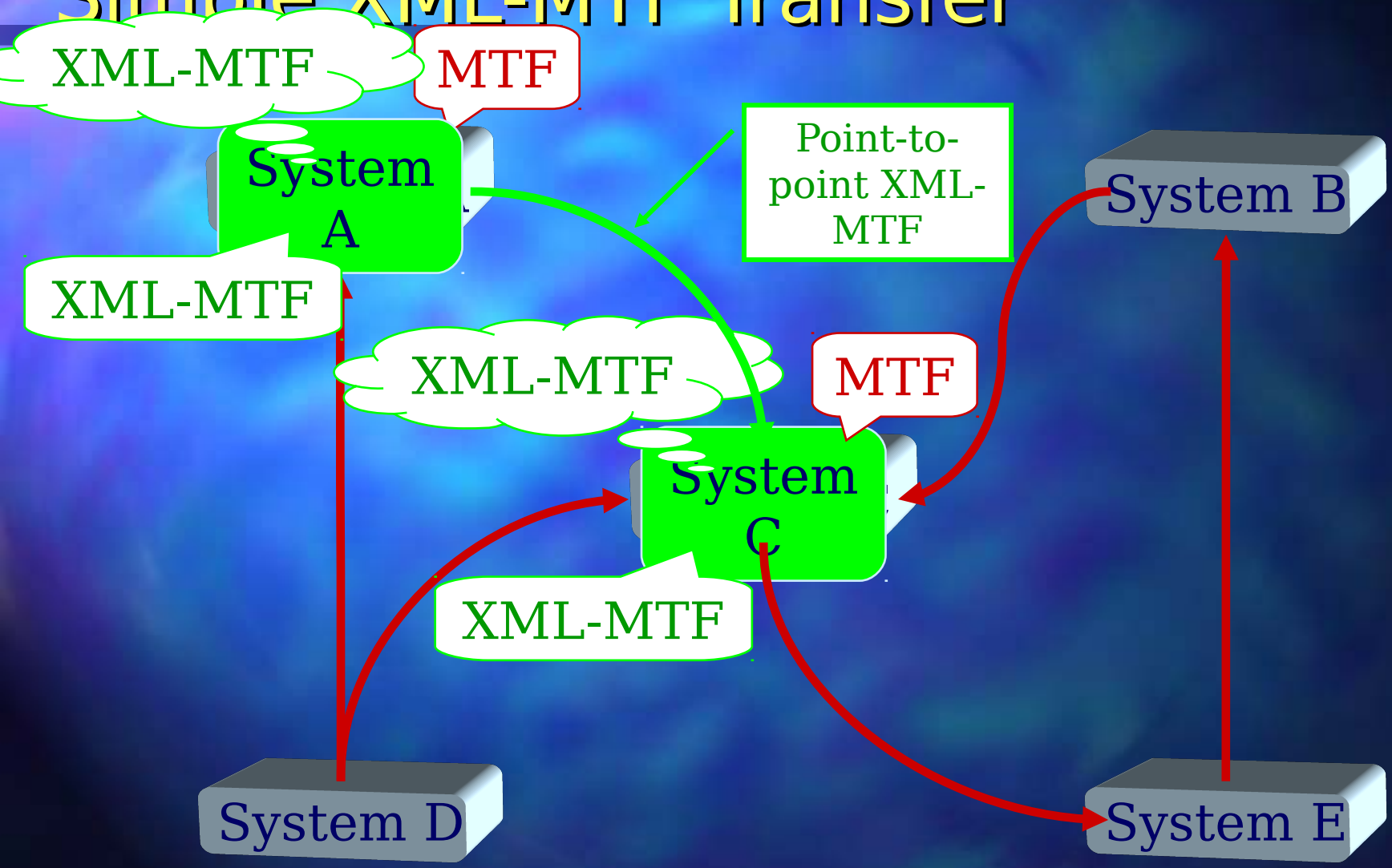

Implementation Strategy
Web XML-MTF Access

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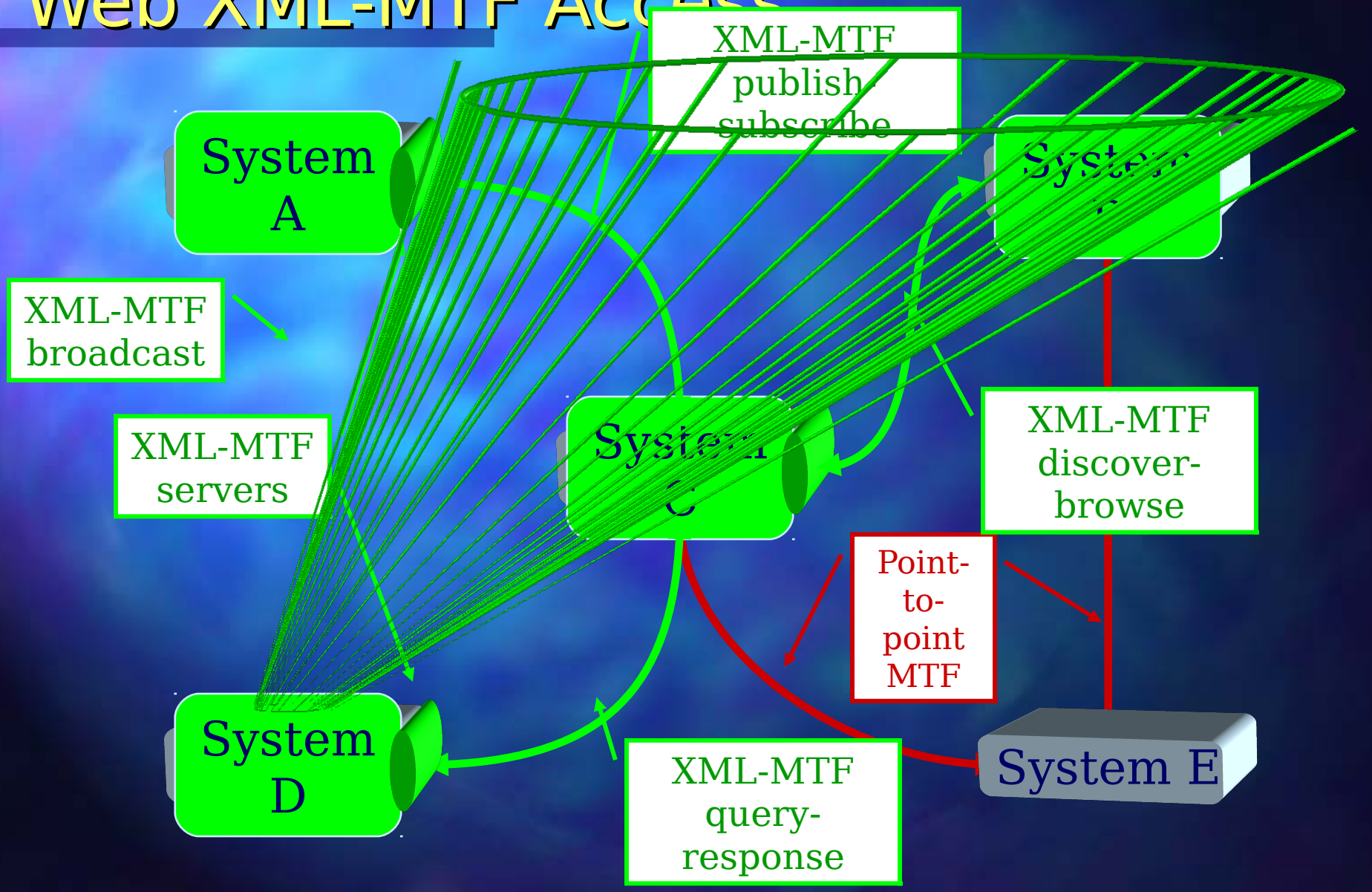

Immediate Benefits

- High quality, low cost, rapidly evolving tools
- Easy to use, familiar, COTS software
- Modern distribution techniques
  - Push, pull, publish, subscribe, broadcast, query …
- Backward compatible (reformatting is easy!)
  - Invisible to systems that only speak MTF
  - Migrate at your own pace
- Flexible, customizable views of information
- Precise searching (e.g., find airbase_status where operational_status=“NOP”)

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Future Opportunities (optional)

- Traditional hyper-linking
  - References, imagery, voice, video, data-tables
- Advanced hyper-linking
  - Distributed, collaborative MTF creation
  - Fused views of MTF products (e.g., all abstats)
  - Personalized battlespace “news”
- Richly formatted free text
- Annotations (e.g., classification, pedigree)
- Non-interfering unscheduled data sets
  - regional extensions, asynchronous implementation

Example: Fused XML-MTF View
XML-MTF in the Battlespace Inf

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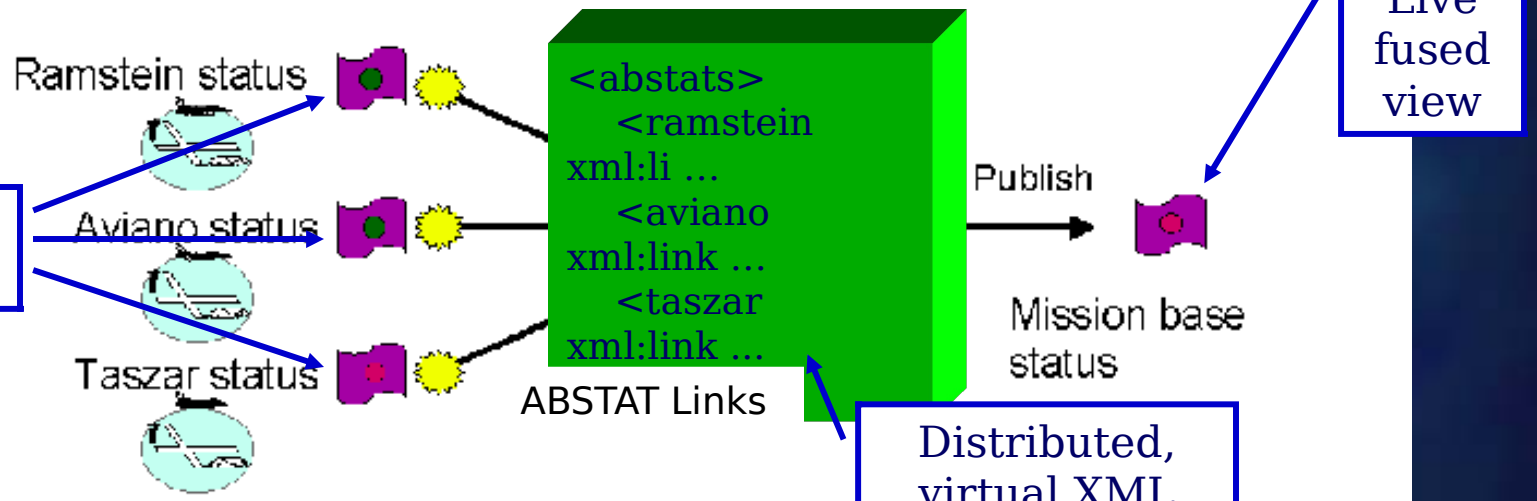
Example: fuselets that aggregate

- Each air base publishes a "base status" object to the BI. A fuselet that has subscribed to this type of object is triggered and publishes an aggregate "mission base status" object.



- Complex aggregation is achieved by cascading fuselets, forming higher-level knowledge.

Taken from 1998 AF SAB Study -- IM to Support the Warrio

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Sampling of DoD XML Activities

- DII COE Data Access TWG: Semi-Structured Data and Metadata Sub-panel
- Intelligence XML Study Group (CIA)
- Intelink
- Secure Intel Data Repository
- Semi-Structured Data Management (Intel R&D)
- GCCS-M
- Logistics Command and Control (CECOM R&D)
- Command Post XXI (CECOM R&D)
- Garlic Fries (Track archiver and archive broker)
- Joint Ammunition Management
- eCommerce for Command & Control and Logistics (ESC R&D)
- Joint Digital Library
- Context-based Object Representation Environment
- Virtual Information Resource Center
- Distributed Information Agents
- Defense Information Technology Testbed

GCCS-M: An Excellent Example Who else plans to use XML for MTI

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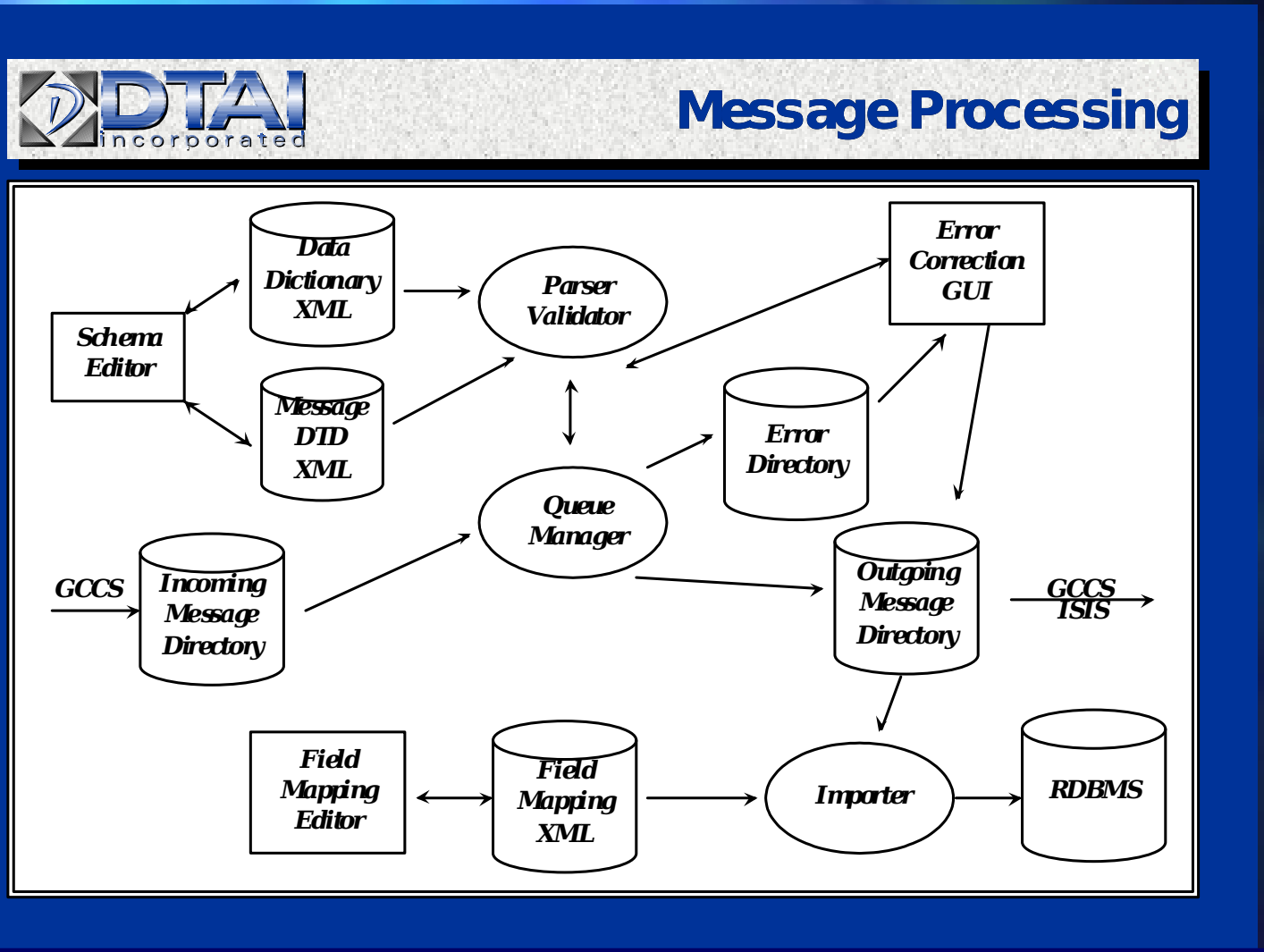

Presented at first DII COE SSDMD meeting (1/12/1999)

Given Time, it Will Happen
Lead or be Led!

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Potential COE Uses of XML

- **Relational and Track Data Synchronization**
  - public visibility of data structure
  - lightweight platform requirements to process data
- **New Message Standard**
  - flexibility, extensibility, accurate portrayal of precision
  - key commercial tools will generate XML as optional format
- **Publishing COE MetaData and Data Assets**
  (Logical Models, Physical Schemas, Mappings, Data)
  - DBMS not required to examine schema or retrieve data
  - users can leverage search engines to locate appropriate data sources
- **Embedded Training Support**
  - developers can create generic, lightweight components to present and process training and testing materials

Presented at first DII COE SSDMD meeting (1/12/1999)

Recommended Actions

- Announce intent to use XML (claim territory)
- Define standard XML-MTF mapping rules
  - Develop annex to MIL-STD 6040
  - Avoid incompatible mappings by numerous users
- Add basic XML capabilities to DII COE MP
  - MTF2XML (JMAPS enhancement) [have prototype]
  - XML2MTF (XSL stylesheet) [have prototype]
- Publish XML-MTF Schemas (CD-ROM, Web)
  - Auto-generate from CDBS [under construction]
- Continue normal management of standard

Additional information

- Information about XML
  - http://xml.com
  - http://www.oasis-open.org/cover/xml.html
  - http://www.w3c.org
  - http://www.microsoft.com/xml
  - http://www.oracle.com/xml
  - http://www.software.ibm.com/xml
  - http://java.developer.com
- DII COE Semi-Structured Data and Metadata Panel
  - http://spider.osfl.disa.mil/dii/aog_twg/twg/ssdmd/ssd-md_page.html
- Intelligence XML Study Group
  - http://www.sgml.saic.com/aat/

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Demo

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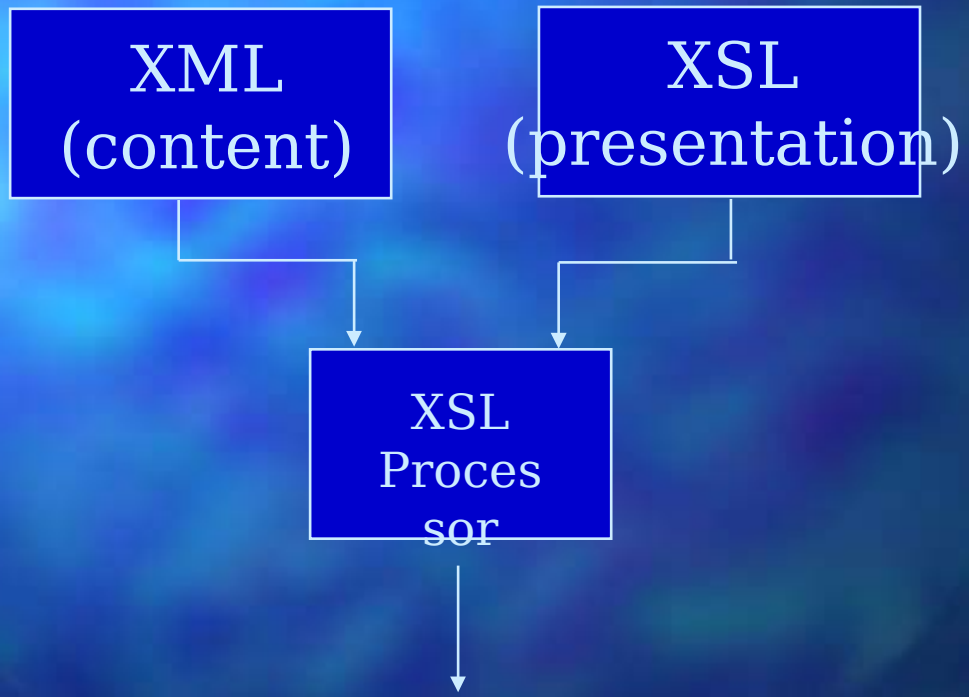
XML + XSL = Presentation



XSL - all about (Template) "Rules"

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- "Hey xsl processor, when you encounter the "root" element (e.g., air_tasking_order) do [action1]"
- "Hey xsl processor, when you encounter the mission_data element do [action2]"
- "Hey xsl processor, when you encounter the mission_number element do [action3]"
- And so forth

XSL Document Structure

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```
<?xml version="1.0"?>
<xsl:stylesheet>
      <xsl:template
match="air_tasking_order">
                  [action]
      </xsl:template>
      <xsl:template
match="mission_data">
                  [action]
      </xsl:template>
      <xsl:template
match="mission_number">
                  [action]
      </xsl:template>
      ...
</xsl:stylesheet>
```

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Backup Slides

FAQ #1: What about bandwidth? Global Grid Example

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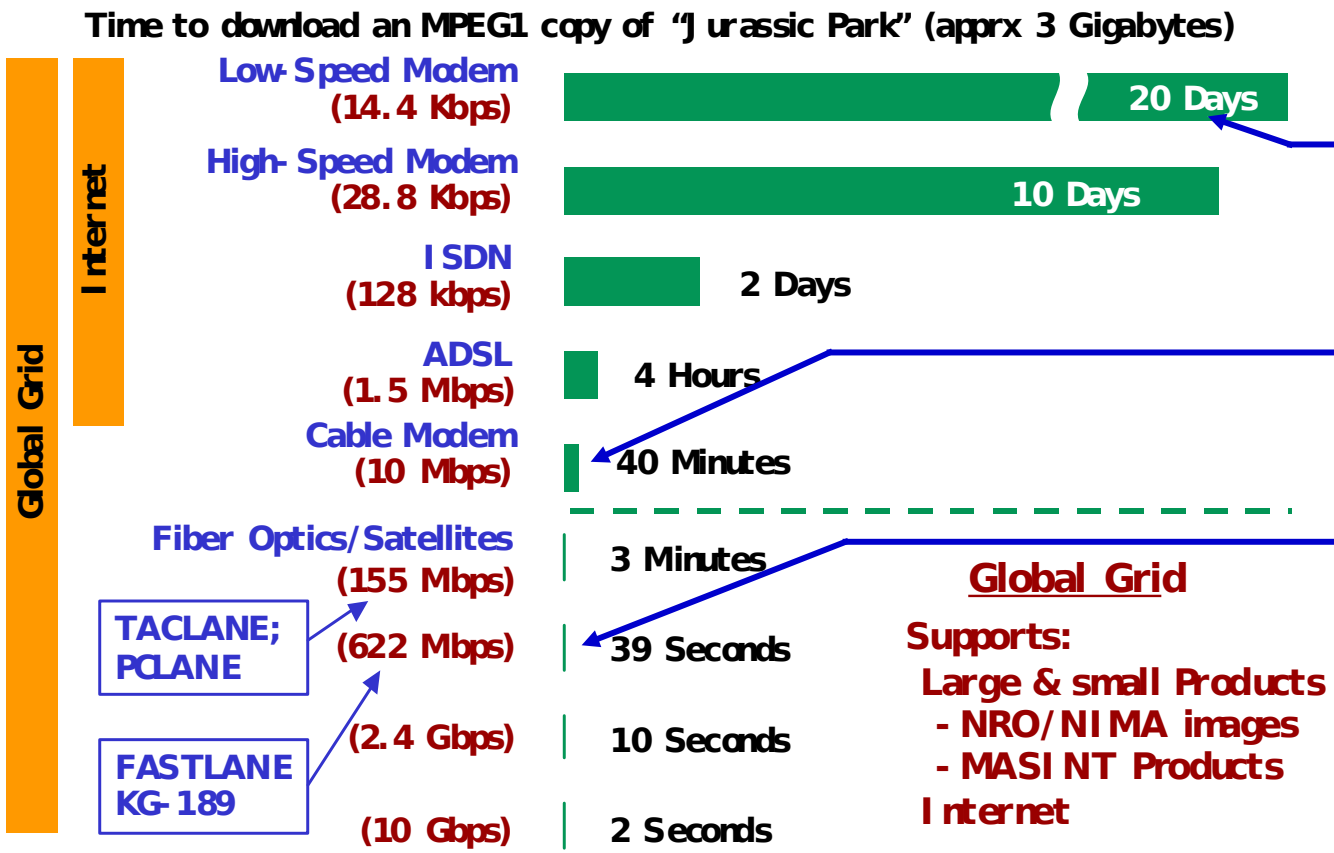
Global Grid Value To Date…



Taken from Global Networked Information Enterprise (GNIE

FAQ #1: What About Bandwidth?

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- XML is a drop in the Web bandwidth bucket
- In Addition:
  - XML is highly compressible (DS ATO=13:1 [93%])
  - XML allows selective retrieval (pull what you need)
  - XML-MTF maps easily back to MTF if needed
- Deploy the right format for the environment
  - MTF is native format for AUTODIN, TARE, …
  - XML is native format for Web environments
- Unify them
  - One information standard. Two format types.
  - Mapping between is reformatting, not translation!

FAQ #2
How does XML relate to HTML?

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- Both are markup languages managed by the W3C
  - A way to describe things in a text file using “tags”
- But, …
  - HTML is a fixed set of tags to describe how to display the text (e.g., <B>=bold, <I>=italics)
  - XML is an extensible set of tags to describe the meaning of the text (e.g., <ship_name>, <target_id>)

HTML Example:

```
<h1> XML Auto Design Basics </h1>
<h2> Dr. Bob Miller </h2>
<h3> The MITRE Corp. </h2>
<h5> drbob@mitre.org </h5>
```

XML Example:

```
<Book>
  <Title> XML Auto Design Basics </Title>
    <Author>
      <Name> Dr. Bob Miller </Name>
      <Affil> The MITRE Corp. </Affil>
      <Email> drbob@mitre.org </Email>
    </Author>
  </Title>
</Book>
```

XML Schemas

- Analogous to USMTF message definition
- Used to describe the structure and content of a given XML document type
  - What will an instance of an XML document contain? (e.g., a purchase order, a phone book record, a target report, etc.)
- Specification against which XML can be validated.
- Standard evolution
  - DTD (part of the XML standard)
  - XML Schema WG working next version

eXtensible Style Language (XSL)

- Similar to JQL Shell (in JMAPS)
- XML alone says nothing about how to present the data (what should it look like?)
- XSL is a flexible language to allow multiple presentations and transformations of a given XML representation
  - Defines some behavior for XML elements
- Soon to be a formal W3C recommendation
- IE5.0 has limited support

Document Object Model

- Similar to MTF-Tools.
- Provides a (procedural) programmatic interface to XML document.
- Allows access via application code, Java, VBScript, etc.
- DOM 1.0 supported in IE5.0.

eXtensible Query Language: XQL

- Similar to JMAPS Query Language (JQL).
- Provides declarative access to XML documents.
  - Resilient to changes in the underlying structure or schema.
- Allows XML documents to be treated as database instances.
  - Information retrieved through interactive queries.

A More Complex Example
A One Mission ATO

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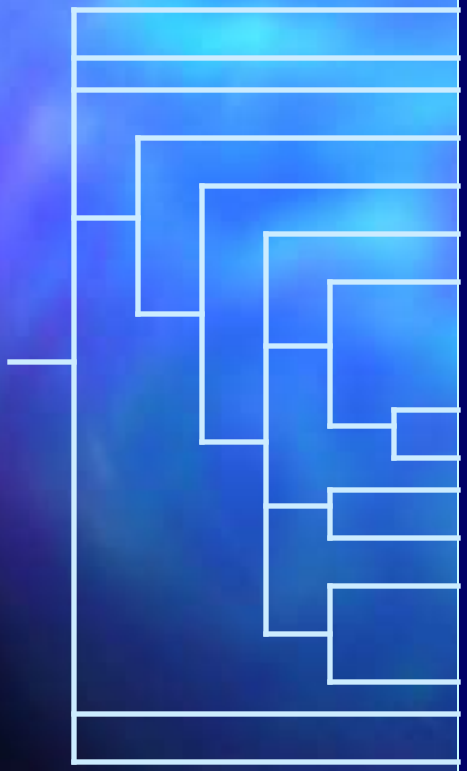

```
EXER/BRAVE GOPHER 90//
MSGID/ATOCONF/TACC//
PERID/300001Z/TO:302359Z//
AIRTASK/RECONNAISSANCE//
TASKUNIT/63 TRS/KXXQ/DET 1 FOL//
MSNDAT/AF0025/-/PHICO 10/1RF4C/REC/-/SLAR/-/34511//
RECDATA/8AA001/PRY:2/301500Z/-/SLAR/AREACOV/SL
/IMQ:S/-/TGTCOD:2ABCDEG/-/VII CORPS
/3BDE, 3RD ARMOR DIV//
TRCPLOT/420035N0153545E/RAD:50NM//
TRCPLOT/494530N1383540W/ELP:380YD-775YD-317.2//
CONTROL/ABC/MOONBEAM/325.8/-/YELLOW/APPLE//
CONTROL/AWAC/NIGHTHAWK/335.9/235.2/325-CH 77-100//
REFUEL/EXXON 10/SAC001/CHEVROLET/280/301330Z/9
/235.8/243.0//
REFUEL/TEXACO 20/2-65/PORSCHE/240/301600Z/8/4YS/2F3//
AKNLDG/YES//
RMKS/       SPECIAL INSTRUCTIONS ...//
```

The Challenge

- Enable Joint and Allied forces to share timely, accurate, complete information in a form that is mutually understandable
- Exploit information embedded in a dynamic array of dissimilar Allied, national and COTS systems
- Mitigate complicating factors, such as differences in
  - Command structures (e.g., JFACC v.s. PSC-CAOC)
  - Operational procedures (e.g., ADMs v.s. ACMs)
  - Information standards (e.g., USMTF v.s. ADatP-3)
  - Languages and cultures

Our Approach

- Insulate forces from disparate information sources via an evolving suite of published interfaces
  - A force is a plug and play component that exposes its information services via published interfaces
- Near Term
  - Exploit existing, mature Information Exchange Requirements (IERs) and develop flexible supporting interfaces using XML
  - Begin migrating DoD information standards
- Longer Term
  - Evaluate new opportunities
  - Investigate convergence of existing information standards

Current Activities

- Inform military standards (US and Allied)
  - Present concepts and migration strategy
  - Establish XML annex for MTF standards (common mapping)
- Track and influence W3C standards
  - Influence via conferences and formal participation in W3C
- Prototype and demonstrate enabling technologies
  - MTF2XML Translator
  - XML-MTF Schema Generator
  - XML2MTF Stylesheet
  - XML-KBC, XML-RT, ...
- Innovate and Explore!

Status

- Military Standards
  - Supported by USAF USMTF representative
  - Plan to brief the USMTF CCB in February 1999
- W3C Standards
  - Initial networking with XML community
  - Participated in W3C Query Languages workshop
- Prototypes
  - MTF2XML - initial prototype completed
  - XML2MTF - initial prototype completed
  - XML-MTF Schema Generator - prototype under construction